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(71) Applicant: **TOYOTA MOTOR CORP**

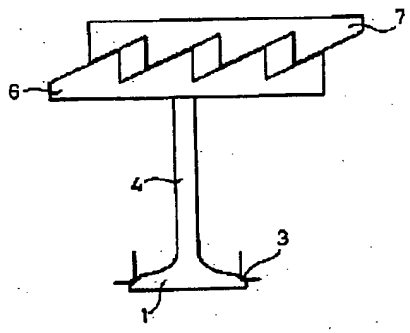
(72) Inventor: **YOTSUEDA KEIJI**

(54) **VALVE OF MAGNETIC SYSTEM FOR INTERNAL COMBUSTION ENGINE**

(57) Abstract:

PROBLEM TO BE SOLVED: To attain both sure valve closing action and minimization of a clearance between a plunger and a magnetic field producing member, even by generating a little change of shape due to thermal expansion, wearing, etc.

SOLUTION: Assuming contact of a plunger 6 with an upper side magnetic field producing member 7 without seating a valve element 1 in a valve seat 3 by thermal expansion or the like of a valve shaft 4, by a slope direction component of magnetic force attracting the plunger 6, it is rotated in the direction of arrow mark, seating of the valve element 1 is attained. On the other hand, regardless of seating of the valve element 1 in the valve seat 3, in the case of providing a clearance between the plunger 6 and the upper side magnetic field producing member 7, by force attracting together by the fellow slopes of the plunger 6 and the upper side magnetic field producing member 7, the plunger 6 is rotated in the reverse direction, so as to make the clearance zero.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the magnetic type valve which controls the drive in a detail using magnetism more about the induction-exhaust valve of an internal combustion engine.
[0002]
[Description of the Prior Art] Conventionally, that switching operation is carried out [that] by the cam shaft driven as an induction-exhaust valve of an internal combustion engine based on rotation of a crankshaft is common. And from a viewpoint of attaining highly efficient-ization of an internal combustion engine, in order to attain the optimal valve timing according to operational status, the adjustable mechanism of a valve gear system is being put in practical use variously, and the thing of continuation adjustable formulas including the thing of a two-step switching formula (ON/OFF controlling expression) is also developed. There are what shifts the rotation phase of a cam shaft, a thing which equips a cam shaft with two or more cam profiles in these adjustable mechanism.
[0003] However, it is impossible to set up independently and arbitrarily the amounts of valve lifts, valve-opening time, and all the opening-and-closing stages in the induction-exhaust valve driven by the above cam shafts. then, the demand of on recent years and as opposed to an internal combustion engine of the further highly-efficient-izing -- it should respond -- operational status -- responding -- those parameters -- the electromagnetism which can be set as an ideal value -- the research on a drive formula valve gear system has been activating for example, Provisional Publication No. such [61 No. -248402 official report] electromagnetism -- an example of the induction-exhaust valve of a drive formula is indicated In the solenoid valve, valve-closing operation is made by attracting to a core the plunger connected with the valve element with electromagnetic force.
[0004]
[Problem(s) to be Solved by the Invention] By the way, in the above-mentioned official report, there is a publication of the purport which forms a magnetic-reluctance layer in a plunger front face, and it is thought with this conventional technology that the contact to a valve element and a valve seat (valve seat (valve seat)) and contact to a plunger and a core are made simultaneously. However, when the internal combustion engine is working, a plunger and a core contact before the stage when a valve element and a valve seat contact by the thermal expansion of a valve stem, or wear between a valve element and a valve seat, and there is a possibility that valve closing may be barred. That it should prevent such un-arranging on the other hand, if path clearance between a plunger and a core is enlarged, the problem that power required in order to maintain a valve-closing state increases will occur.
[0005] even if the purpose of this invention has some configuration change by thermal expansion, wear, etc. in view of this actual condition -- positive valve-closing operation, a plunger, and magnetic field generation -- a member -- it is in offering the magnetic type valve for internal combustion engines which can aim at coexistence with path clearance minimization of a between
[0006]
[Means for Solving the Problem] The magnetic type valve of an internal combustion engine concerning this invention thought out that the above-mentioned purpose should be attained is characterized by providing the plunger with which the field by the side of the suction direction

consists of two or more slant faces which inclined in the hoop direction in the magnetic type valve of an internal combustion engine which holds a valve to a closed position, and the magnetic field generation member which has a plunger receptacle side corresponding to two or more of these slant faces by attracting a plunger by magnetism.
[0007] In the magnetic type valve of an internal combustion engine constituted like **** even if a valve configuration will change with thermal expansion, wear, etc. and which of the contact time of a valve element and a valve seat and the contact time of a plunger and a magnetic field generation member will become first a plunger and magnetic field generation -- since the plunger receptacle side of a member forms the slant face in a hoop direction -- a plunger -- magnetic field generation -- a member -- by being drawn in by magnetism and rotating to a direction, the path clearance minimization between positive valve-closing operation, a plunger, and a core is attained
[0008]
[Embodiments of the Invention] Hereafter, the operation form of this invention is explained with reference to an accompanying drawing.
[0009] Drawing 1 is drawing of longitudinal section of the magnetic type valve of an internal combustion engine concerning one example of this invention. The valve element 1 shown in this drawing opens and closes the port 2 for pumping by sitting down to the valve seat 3 prepared in the port 2 for pumping of an internal combustion engine, or ****(ing) from a valve seat 3. The valve stem 4 is being fixed to the valve element 1. This valve stem 4 is held by the valve guide 5 in the state which can slide on shaft orientations. Moreover, the plunger 6 is being fixed to the valve stem 4. A plunger 6 is the disc-like member which consisted of soft magnetic materials. the upper part of a plunger 6 -- predetermined distance -- being isolated -- upper (upper) side magnetic field generation -- a member 7 -- on the other hand -- the lower part -- the same -- predetermined distance -- being isolated -- ROA (lower) side magnetic field generation -- the member 8 is arranged, respectively
[0010] upper side magnetic field generation -- a member 7 consists of an upper core (upper core) 71 and an upper coil (upper coil) 72 -- having -- the same -- ROA side magnetic field generation -- a member 8 consists of a lower core (lower core) 81 and a lower coil (lower coil) 82 The upper core 71 and the lower core 81 consist of soft magnetic materials, and are held in the case 9 which consists of non-magnetic materials at the position relation. Moreover, while the upper coil 72 is grasped by the upper core 71, the lower coil 82 is grasped by the lower core 81.
[0011] Moreover, the valve stem 4 is elastically supported by shaft orientations with the upper side spring 10 and the ROA side spring 11. and energization should do to the upper coil 72 and a lower coil 82 -- the position (center valve position) of the plunger 6 in case there is nothing -- upper side magnetic field generation -- a member 7 and ROA side magnetic field generation -- the balance with the upper side spring 10 and the ROA side spring 11 is achieved so that it may become the mid-position with a member 8 in addition -- the time of a plunger 6 being in a center valve position -- a valve element 1 -- a full open side -- a variation rate -- an edge side and a close-by-pass-bulb-completely side -- a variation rate -- the mid-position with an edge is taken
[0012] According to this composition, the magnetic circuit which becomes the circumference of the upper coil 72 from the air gap formed between the upper core 71, a plunger 6, and the upper core 71 and a plunger 6 is formed. Therefore, if current is passed by the upper coil 72, magnetic flux will flow back the inside of the above-mentioned magnetic circuit, and the magnetism of a direction to which the variation rate of the direction 6, i.e., the plunger, which makes an air gap small is carried out upwards will occur.
[0013] The magnetic circuit which becomes the circumference of a lower coil 82 from the air gap formed between a lower core 81, a plunger 6, and a lower core 81 and a plunger 6 on the other hand is formed. Therefore, if current is passed by the lower coil 82, the magnetism of a direction to which the variation rate of the plunger 6 is carried out to a lower part will occur from the same principle.
[0014] In this way, it becomes possible by passing current by turns to the upper coil 72 and a lower coil 82 to make a plunger 6 move reciprocately up and down in the opening-and-closing direction, i.e., to drive a valve element 1 by turns.
[0015] by the way, when holding a valve to a closed state, it energizes in the upper coil 72 and magnetism is generated -- making -- a plunger 6 -- upper side magnetic field generation -- in order to draw in to a member 7 side -- upper side magnetic field generation -- power consumption can be

decreased, so that the path clearance between a member 7 and a plunger 6 is small if this path clearance is set as zero, before [however,] a valve element 1 and a valve seat 3 will contact according to the thermal expansion of a valve etc. -- a plunger 6 and upper side magnetic field generation -- when a member 7 contacts, there is a possibility that it may become impossible for a valve element 1 to sit down to a valve seat 3 consequently, and it may become impossible to maintain the airtightness of an internal combustion engine therefore, a plunger 6 and upper side magnetic field generation -- it will be necessary to set up the path clearance between members 7 beyond a certain value, and power consumption will increase as a result

[0016] then -- the configuration which consists the upper surface of a plunger 6 of N vertical planes, plurality, i.e., N slant faces, as shown in drawing 2 , in this invention -- carrying out -- it -- corresponding -- upper side magnetic field generation -- the undersurface of a member 7 is also made into the same configuration as this In addition, drawing 2 shows the case of N= 6.

[0017] If circular cylindrical coordinates (r, theta, z) as taken theta axis of coordinates to r axis of coordinates and a valve-stem hoop direction, and taken a z-coordinate shaft in the direction of a valve stem to the valve-stem radial, namely, shown in drawing 3 are adopted and the height of N and a slant face is set to H for the number of slant faces, an above-mentioned slant face will be expressed as follows in detail. However, the z-coordinate of the lowest edge of a slant face is set to 0, and theta coordinate of the lowest edge of one certain slant face is set to 0.

[0018]

0< theta<=T At the time z=Hx (theta/T)

At the time of T<theta <=2T z=Hx [(theta-T)/T]

At the time of 2 T<theta <=3T z=Hx [(theta-2T)/T]

: : : : (N-1) At the time of T<theta<=NT z=Hx [{theta-(N-1) T}/T]

It corrects. T= 360-/N [0019] Thus, it is the function for which z (0 <=z<=H) does not depend for on r, but it depends only on theta, and the relation between theta and z is shown in drawing 4 .

[0020] moreover, the state where the valve element 1 sat down to the valve seat 3 as it was shown in drawing 5 by this example at the time of shipment between the colds, when it was in the state where the length from a plunger 6 to a valve element 1 is the shortest -- setting -- the slant-face best edge of a plunger 6 -- upper side magnetic field generation -- it is set up so that it may contact near the center of the slant face of a member 7

[0021] After being set as such an initial state, the case where the thermal expansion of a valve stem 4 etc. occurs is assumed. the ** to which a valve element 1 does not sit down in this case -- a plunger 6 and upper side magnetic field generation -- supposing a member 7 contacts, by the direction component of a slant face of magnetism which attracts a plunger 6, a plunger 6 will rotate in the direction of the arrow shown in drawing 6 , consequently taking a seat to the valve seat 3 of a valve element 1 will be attained in addition, that case -- a plunger 6 and upper side magnetic field generation -- making small coefficient of friction between members 7, slant-face height H, and several slant faces -- it is possible by taking N [large] etc. to make the force of a hand of cut increase

[0022] although the valve element 1 sat down to the valve seat 3 by recovery from the thermal expansion of a valve stem 4 etc. on the other hand -- a plunger 6 and upper side magnetic field generation -- the case where path clearance exists between members 7 is considered in this case, a plunger 6 and upper side magnetic field generation -- according to the force in which slant-face entirety with a member 7 pays well, a plunger 6 will rotate in the direction of the arrow shown in drawing 7 , consequently path clearance serves as zero in addition, this time -- the vertical plane of a plunger 6, and upper side magnetic field generation -- it is possible by applying or plating the matter with small permeability to the vertical plane of a member 7 to make the force of a hand of cut increase

[0023] as mentioned above, taking a seat with a valve element positive [the structure of this example] and plunger side and upper side magnetic field generation -- it is always compatible and minimization of the path clearance between members is realized

[0024] As mentioned above, although the example of this invention has been described, it will be easy for this contractor for this invention not to be limited to this and to think out various examples, of course. For example, it is good also considering the upper side magnetic field generation member

of this example as a permanent magnet. Moreover, you may omit the ROA side magnetic field generation member of this example, and a ROA side spring. In addition, if height H of a slant face is set up more greatly, since aging by wear of a valve seat etc. will also be absorbed, the performance and power consumption at the time of shipment are maintainable for a long period of time.
[0025]
[Effect of the Invention] as explained above, even if there is some configuration change by thermal expansion, wear, etc. according to this invention -- positive valve-closing operation, a plunger, and magnetic field generation -- a member -- the magnetic type valve for internal combustion engines which can aim at coexistence with path clearance minimization of a between is offered

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CLAIMS

[Claim(s)]
[Claim 1] The magnetic type valve of an internal combustion engine characterized by providing the plunger with which the field by the side of the suction direction consists of two or more slant faces which inclined in the hoop direction in the magnetic type valve of an internal combustion engine which holds a valve to a closed position by attracting a plunger by magnetism, and the magnetic field generation member which has a plunger receptacle side corresponding to two or more of these slant faces.

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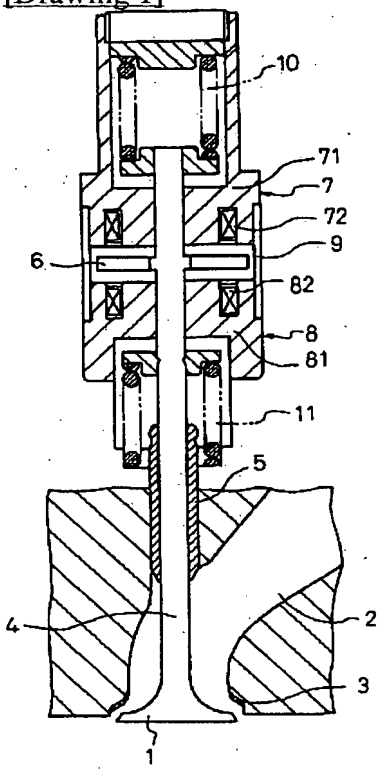
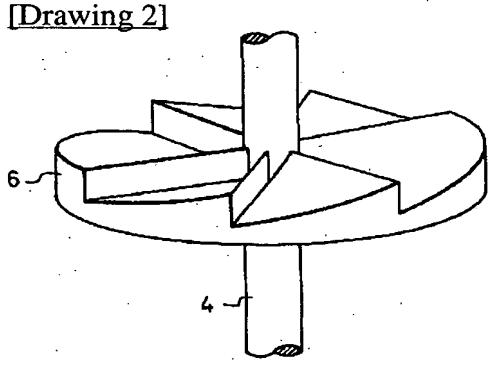
DRAWINGS

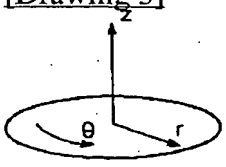
[Drawing 1]



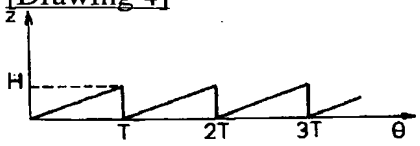
[Drawing 2]



[Drawing 3]



[Drawing 4]



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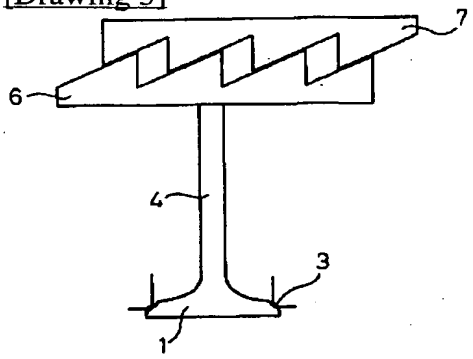
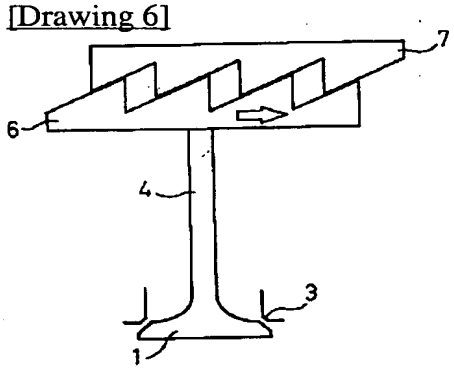
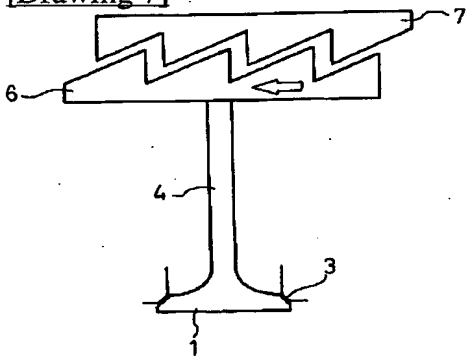


[Drawing 6]



[Drawing 7]



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